Animal Fats in Livestock Feeds

#86

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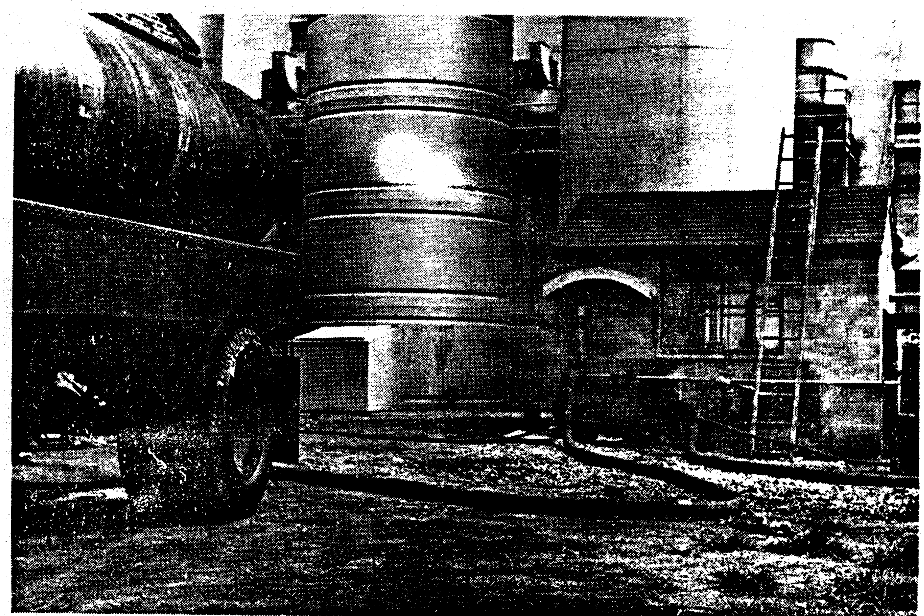
A substantial new market outlet for inedible animal fats in livestock feeds has resulted from research sparked by an investigation sponsored by the Eastern Utilization Research Branch of the Agricultural Research Service, U. S. Department of Agriculture and carried out in the laboratories of the American Meat Institute Foundation of the University of Chicago. This early work pointed specifically to the advantages of incorporating fats in rations for dogs and broilers. Other studies conducted at the University of Wisconsin, University of Nebraska, University of Florida, Purdue University, Texas A & M College, Oklahoma A & M College, University of Connecticut, North Carolina State College and other laboratories indicate that inedible fats can be used advantageously in rations for beef cattle, swine and sheep in addition to those animals studied in the first tests.

These investigations have proved to be of almost immediate benefit to livestock growers, packers, renderers and feed manufacturers. Only about a year has elapsed since the initial investigations were completed, yet fats are now being incorporated in feeds at the rate of millions of pounds annually. In fact, manufacturers whose primary activity is the production of prepared animal feeds used an estimated total of 31 million pounds of grease, tallow and other fats and oils during the first quarter of 1954, according to data recently released by the Bureau of Census. Of this total, 16 million pounds were the animal fats, tallow and grease. The remainder was classified as "other" fats and oils and presumably was principally vegetable and animal "foots" an oil-rich byproduct which is obtained during the refining of edible fats and oils. Several people in close touch with this industry feel that this use of inedible fats is still expanding rapidly.



Fat for Use in Animal Feeds Being Delivered Through Pump House into Large Storage Tanks in the Background. (U.S.D.A. photos by M. C. Audsley.)

Inedible animal fats are inexpensive, plentiful, recurring natural resources obtained as byproducts of the domestic livestock industry. Because they are byproducts, their production cannot be controlled, but in fact, will increase as meat production increases. The increased production of inedible animal fats, coupled with increasing competition from synthetic detergents in their most important outlet (soap), has caused large surpluses of inedible animal fats to be available; in 1953 over 2½ billion pounds were produced—an excess of about one billion pounds above our domestic demand. While the existence of large export markets has been fortunate, dependence upon them as an outlet for over one-third of their production has weakened the bargaining position of the inedible fat producers. This has resulted in extremely low prices for animal fats, prices as low as 2½ to 5 cents per pound generally prevailing during 1952 and 1953. The low price and the large quantities available make inedible animal fats attractive not only as a component in animal feeds, but also as potential raw materials, particularly in the chemical industry.

One factor contributing to our interest in investigation of animal fats as a feed constituent has been the lowered fat content of feeds which resulted from conversion to more efficient extraction methods by the oilseed milling industry. For example, this conversion has reduced the average fat content of the soybean protein meals used in feeds from about 5 percent to about 1 percent.

From a nutritional viewpoint, fats are high energy foods; they yield 9 calories per gram when metabolized, whereas starch and protein each yield only approximately 4 calories per gram. For use in feeds, the fats must compete with other cheap sources of energy, principally with corn. Because of moisture and crude fiber present, the caloric value of corn is about 3.5 per gram. Hence with corn at 3 cents per pound, simple arithmetic indicates fats are worth about 7.7 cents per pound. However, fats are 90-95 percent digested and ab-

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sorbed, whereas Morrison's tables indicate corn is 80 percent utilized. Therefore, the energy value of fat relative to corn at 3 cents per pound is about 8 cents.

In general, this calculated value may be considered as being a minimum. There are numerous indications that incorporation of increased fat contributes to the efficiency of utilization of other nutrients in certain rations.

It is hardly to be expected that the incorporation of fats in the rations of all animals will be equally advantageous. Most of the early work which has been reported investigated the merits of incorporating additional fats in the rations of dogs and poultry. Since those early reports, studies have been made on diets containing added fats for swine, cattle and lambs. The monetary value of fat as a constituent of feeds for various animals has been summarized most cogently by Rice and coworkers of Swift and Company. Data shown in Table I are adapted from their presentation. The figures shown represent the actual experimentally determined value of fat under controlled conditions of feeding. It will be observed that in most cases, the experimentally determined value of the fat is greater than the minimal theoretical value of approximately 8 cents per pound.

In general, inedible animal fats do not contain any toxic substances whatever, but are classified as inedible largely for aesthetic reasons. Aside from traces of odor and color bearing materials which may be present, their chemical composition approaches that of the corresponding types of edible fats, namely lard and tallow.

Equipment for Metering Various Constituents in Continuous Process for Feed Manufacture.

The inedible animal fats are available in a variety of grades which differ from each other principally in color and free fatty acid content. Free fatty acids are digestible and hence are not objectionable, per se, when the fat is to be used in feeds. On the other hand a high free fatty acid content indicates that the fat may have been subjected to conditions conducive to development of other undesirable qualities such as an unusually poor storage life. It is largely for this reason that the lowest grades of fats with very high free fatty acid content are usually not recommended for incorporation in feeds.

It is recommended that all inedible animal fats be treated with an antioxidant before their incorporation into feeds. The antioxidar treatment may be accomplishe either by addition of the antioxidant during rendering in the required proportions or by its addition to the rendered fat. The proportions to be used and other details of use will differ with different antioxidants and different stocks being treated. It is, therefore, usually a good idea for renderers to follow the recommendations of the manufacturer of the specific antioxidant chosen for use.

There are several good reasons for the use of antioxidants in animal fats which are to be added to feeds. First, to retard oxidation of fats in the feeds which otherwise would cause rapid and extensive vitamin destruction; the addition of properly stabilized fats appears to delay vitamin destruction in the mixed feed. Second, to prevent development of undesirable odors and flavors characteristic of rancidity, thereby maintaining the palatability of the feed.

The Federal Meat Inspection Service has issued regulations permitting the use in animal fats under certain prescribed conditions, of a number of different antioxidants. This per-

TABLE I
Value of Animal Fat for Addition to Animal Rations Experimentally Determined

Animal Fed	Number of Animals in Experiment	Fat Added to Diet Percent by Weight	Return for Fat cents/lb.
Broilers	1100	3	13.3
Broilers	1125	3	7.7
Broilers	20	5	12.0
Chickens	150	2	9.0
Chickens	150	4	9.5
Chickens	150	8	6.6
Ducks	20	5	8.0
Ducks	20	5	4.2
Turkeys	30	5	14.2
Swine	10	3	6.2
Swine	10	5[1]	8.6
Swine	----	10	10.0
Steers	10	3.4	12.5

[1]Fattening period only.

structure, microbiological balances, soil nutrients and their availability, and soil pest control, can be tremendous. We have had responses to some soil applications that lead us to wonder if we ever see completely healthy, uninhibited plant growth under normal agricultural practice.

Nor are we neglecting the plants above the ground. Our research program includes such basic chemistry and biochemistry. From such fundamental thinking we are getting a constant stream of new chemicals for growth regulation, cotton defoliation, weed control, fungus control, systemic insecticides and miticides, residual control of flies and mosquitoes and other important uses. Some of our interesting chemicals are passed on to other research workers to be tried for such varied applications as fish killing agents, for algae control, for chemical warfare agents, for cure of skin fungi, as anthelminics for man and animals, and even as food supplements.

In conclusion, let's return to the behind-the-scenes biography of our hypothetical insecticide. After spending a million and a quarter dollars on her debut, our baby has become a young lady. We thing she is pretty nice. We can pay no higher tribute to you gentlemen than to say that we are willing to entrust her to your care. Treat her gently. Respect her. We have spent a lot of money on her upbringing. It is true she has associated with pretty rough people in the past and may have to do so again in the future. But she would not have been given to you if we did not have confidence in her and in you. May you both profit from the association.

Farm Surpluses

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more efficient processing. Often the problem is created by gains in technology in crop production. For example, increasing use of mechanical pickers in the cotton field means more trashy lint at the mill. And one of the most effective developments in recent research is a cotton opener that does an unusually good job of getting heavy trash out of the cotton. The opener has other advantages. It reduces the loss of spinnable lint and helps to give strong, better quality yarn. As a result it saves some mills around $1 on each bale processed. Although the device was released commercially only three years ago, it is now being used in mills that process around one million bales of cotton each year.

Scientists in utilization research see many other possibilities for good returns from farm products now in surplus or being marketed at a loss. In cotton they would like to give more attention to the search for chemical methods that will impart new and valuable properties to the fiber and to developing cotton products for specific markets. They would like to investigate the chemical potentialities of wheat as an industrial raw material. And they would like to develop the basic information needed to take advantage of the properties peculiar to inedible animal fats and other raw materials on the farm.

Animal Fats

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mission is granted only after the Food and Drug Administration has indicated that based on adequate toxicity tests the substances are safe for the use in the manner prescribed.

Among those approved antioxidants are butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), propyl gallate, nordihydroguaiaretic acid (NDGA), lecithin, citric acid and phosphoric acid. Of these BHA and its combinations with propyl gallate and citric acid have been most extensively ivestigated. Several other antioxidants for which limited toxicity data are as yet available offer some possibility of use. Among these are Santoquin (6 ethoxy-1,2-dihydro-2,2,4-trimethylquinoline) and diphenyl-p-phenylenediamine (DPPD). Santoquin has been found effective in preserving the carotene content of dehydrated alfalfa meal and may be used for this purpose for alfalfa which is to be fed only to poultry. Similarly DPPD has been approved for use in poultry feeds. It is reported to reduce the incidence of nutritional encephalomalacia or "crazy chick" disease. Much more toxicity data would be required, however, before this latter compound would be satisfactory for inclusion in feeds other than those for poultry.

No hard and fast rule can be made regarding the stability to be required for fat which is to be added to feedstuffs. This is primarily due to the fact that no exact correlation exists between stability as determined by a laboratory test and the keeping life which will be observed under the wide variety of commercial storage conditions to be found. In general, a stability of 20 hours as measured by the widely used Swift Stability Test (Active Oxygen Method) is not too difficult to attain and provides reasonable assurance of satisfactory results.

Advantages gained by the use of stabilized animal fats in feeds include increased feed efficiency, increased vitamin stability, increased palatability, improved appearance, increased ease of pelleting, decreased wear on conveyors, mixing and pelleting equipment and control of dustiness. Some of these advantages such as improved appearance are of primary value to the feed manufacturer, whereas others such as increased feed efficiency are most valuable to the feed users. Others, such as control of dustiness are advantageous to all who handle the feed. For example, excessive dustiness in feed mills not only is disagreeable to the mill workers who operate the machinery for grinding, mixing, pelleting, and bagging the feed components, but also is a health and explosion hazard. It is also objectionable to the farmer in handling the feed, and substantial losses can occur unless the feeders are well protected from wind.

The potential outlet for fats in animal feeds is tremendous; about 34 million tons per year of livestock and poultry feed were manufactured in 1952 and 1953. Of this about 60 percent was poultry feed of the various types. Addition of one percent fat to all feeds would require nearly 700,000 pounds annually which is over 25% of our production of inedible animal fats. Addition of three percent fat to poultry feeds alone would require 1,200 million pounds, or nearly half the annual production of these fats.

On the other hand there does not appear to be any reason to suppose that inedible fats will not be available for incorporation into feeds in the proportions desired. For one thing, it seems probable that considerable amounts of "foots" obtained from the refining of vegetable oils will be used for addition to feeds. It is also probable that this new use will stabilize prices for inedible fats and thereby provide incentive for increased production which can be achieved through improvement for collecting and processing operations.